

TOSS-UP

1. ASTRONOMY: Short Answer: Though its second was launched before its first, they both celebrated their 25th anniversary during 2002. What pair of space probes visited Jupiter, Saturn, Neptune and Uranus between them?

ANSWER: Voyager

BONUS

1. ASTRONOMY: Short Answer: What constellation contains the star Albireo at its beak, the star Deneb at its tail, and three other stars that form its wingspan?

ANSWER: Cygnus (or the swan)

TOSS-UP

2. BIOLOGY: Short Answer: His most famous discovery came in 1898, and he won the Nobel Prize 8 years later. Name this Italian biologist whose name is used to describe the part of a cell that receives proteins for packaging from the endoplasmic reticulum.

ANSWER: Camillo Golgi (Golgi bodies)

BONUS

2. BIOLOGY: Multiple Choice: Medical-school students know that Camillo Golgi also discovered Type I and Type II of what kind of cells found in the human body?

- W) epithelial cells [ep-a-THEE-lee-ul]
- X) neurons
- Y) ganglions [GANG-lee-onz]
- Z) squamous cells

ANSWER: X) neurons

TOSS-UP

3. MATH: Multiple Choice: When the equation $r^2 = a^2 \sin 2\theta$ is graphed, the resulting curve, known as a "lemniscate", is shaped like:

- W) a cylinder
- X) a figure 8
- Y) a spiral
- Z) a hyperbola

ANSWER: **X) a figure 8**

BONUS

3. MATH: Short Answer: Calculate the value of dy/dx if $y = 5u^2 + 6$ and $u = 3x - 5$.

ANSWER: $dy/dx = \mathbf{90x - 150}$ (by chain rule) (prompt on "30u")

TOSS-UP

4. PHYSICS: Multiple Choice: What type of electronic filter would best be used to select a frequency range of 20-50 kHz out of a larger range of 1-100 kHz?

- W) notch filter
- X) bandpass filter
- Y) low-pass filter
- Z) high-pass filter

ANSWER: **X) bandpass filter**

BONUS

4. PHYSICS: Short Answer: Time begins on the left and ends on the right, a wavy line is a photon, and an arrow to the right is an electron in what type of diagram, named for a former Caltech physicist?

ANSWER: **Feynman** [FINE-munn] **diagram**

TOSS-UP

5. GENERAL SCIENCE: Short Answer: As an ambulance gets closer to you, the tone of its siren gets higher. As it goes away from you, the tone gets lower. This is one example of--what effect named for an Austrian physicist?

ANSWER: Doppler effect

BONUS

5. GENERAL SCIENCE: Short Answer: In astronomy, the Doppler effect says that radiation will shift what color when its wavelength increases?

ANSWER: redshift

TOSS-UP

6. CHEMISTRY: Short Answer: If the ideal gas equation is written in the form $PV = nkT$, n is the number of moles and k is what constant?

ANSWER: Boltzmann's constant

BONUS

6. CHEMISTRY: Short Answer: His classic text *Principles of Chemistry* was succeeded in 1871 by his draft of the periodic table that left spaces for elements not yet discovered. Name this pioneering Russian scientist.

ANSWER: Dmitri Mendeleev [men-da-LAY-yev]

TOSS-UP

7. EARTH SCIENCE: Short Answer: In 1863, chemists discovered there are actually two kinds of it: the one from Myanmar (which has the name everyone knows) and the one from China, called nephrite. Name this type of precious stone whose "imperial" variety is emerald green.

ANSWER: jade

BONUS

7. EARTH SCIENCE: Multiple Choice: Psychrometers [sigh-CRAW-ma-turz] and hygrometers [hi-GRAW-ma-turz] both measure:

- W) electron voltage
- X) wind speed
- Y) capacitance
- Z) humidity

ANSWER: Z) humidity

TOSS-UP

8. MATH: Multiple Choice: The surface area (in square inches) of a rectangular prism 2 inches by 5 inches by 9 inches is equal to:

- W) 73
- X) 90
- Y) 146
- Z) 292

ANSWER: Y) 146 ($2 \times [10 + 18 + 45]$)

BONUS

8. MATH: Short Answer: A pair of variables x and y are related by the equation $y = kx + z$. Calculate z when k is 1, x is 9 and y is 24.

ANSWER: 15

TOSS-UP

9. BIOLOGY: Short Answer: The opossum is the only North American variety of what type of mammal that includes Australian animals like wombats and kangaroos and keeps their young in pouches?

ANSWER: marsupials

BONUS

9. BIOLOGY: Short Answer: "Small" ones include sheep, goats, llamas and deer, while "large" ones include giraffes, camels and cows. Name this class of animals that chews their cud and has multiple stomach chambers.

ANSWER: ruminants

TOSS-UP

10. CURRENT EVENTS: Multiple Choice: According to the website of *Scientific American* in 2004, four different crops combine to produce more than half of the world's energy that comes from eating food. Which of these crops is NOT one of the four?

- W) wheat
- X) beans
- Y) potatoes
- Z) rice

ANSWER: X) beans (the 4th crop is corn or maize)

BONUS

10. CURRENT EVENTS: Multiple Choice: In March 2004, French scientists announced the success of a drug called "rimonabant" [ra-MON-a-bont] that promises to help fight the two most common causes of preventable death in America, which are:

- W) tobacco and alcohol
- X) alcohol and overeating
- Y) alcohol and car accidents
- Z) tobacco and overeating

ANSWER: Z) tobacco and overeating

TOSS-UP

11. ASTRONOMY: Multiple Choice: The recent book *For Spacious Skies* was written by Scott Carpenter, who became the second American to orbit the earth after he served as the backup for what man who was the first?

- W) Alan Shepherd
- X) Virgil Grissom
- Y) John Glenn
- Z) Buzz Aldrin

ANSWER: Y) John Glenn

BONUS

11. ASTRONOMY: Short Answer: On a white, perfectly reflective surface, its value is 1; on a black, perfectly absorbing surface, the value would be zero. Give this term that measures the intrinsic brightness of an astronomical object.

ANSWER: albedo

TOSS-UP

12. GENERAL SCIENCE: Short Answer: In a 1903 article for *Popular Mechanics*, he wrote about his work with both X-rays and radioactive elements. Name this inventor more famous for creating the phonograph and the light bulb.

ANSWER: Thomas Edison

BONUS

12. GENERAL SCIENCE: Short Answer: It could only go 84 miles per hour but carried more than 1,000 passengers across the Atlantic before it blew up in New Jersey in 1937. Name this ill-fated zeppelin.

ANSWER: Hindenburg

TOSS-UP

13. CHEMISTRY: Short Answer: The hydroxides of metals like lead, tin and zinc can all be described by this term, as can plain ordinary water. What chemical term describes substances that, depending on what they're mixed with, can react as either an acid or a base?

ANSWER: amphoteric

BONUS

13. CHEMISTRY: Short Answer: Folk remedies for it include orange juice and mouthwash. One more recent (and chemically logical) solution combines liquid soap, hydrogen peroxide and baking soda. Name this problem that has turned many suffering animals pink after their owners tried to solve it with tomato juice.

ANSWER: getting sprayed by a skunk

TOSS-UP

14. PHYSICS: Multiple Choice: When a neutron undergoes beta decay, it splits into three different particles. Which of the following is NOT one of those particles?

- W) proton
- X) electron
- Y) meson [MAY-zonn]
- Z) antineutrino

ANSWER: Y) meson

BONUS

14. PHYSICS: Short Answer: When a charged particle travels through a medium at greater than the speed of light for that medium, it emits a bluish light that is named for what Russian physicist?

ANSWER: Cherenkov radiation or effect

TOSS-UP

15. MATH: Multiple Choice: Many companies now use a "six sigma" system to reduce the variation of the products they output. If a company succeeds in implementing the system, what is the maximum number of defective parts they would make in any group of one million parts?

- W) 1
- X) 3
- Y) 5
- Z) 12

ANSWER: X) 3 (actually, it's 3.4, but 3 on a whole-number basis)

BONUS

15. MATH: Multiple Choice: Set A is "leap years between 1941 and 1983", set B is "numbers that end in 4 between 1,900 and 2,100" and set C is "multiples of 10 between 1,800 and 2,200." Find the union of sets B and C, and then tell which of the following numbers is NOT in the intersection of that union with set A:

- W) 1944
- X) 1960
- Y) 1968
- Z) 1980

ANSWER: Y) 1968

TOSS-UP

16. BIOLOGY: Short Answer: It kills hard-shelled animals by injecting poison from its salivary glands. Name this mollusk that escapes enemies by ejecting clouds of ink and has a ring of 8 tentacles around its mouth.

ANSWER: octopus

BONUS

16. BIOLOGY: Short Answer: His most famous theory was disproved by Charles Darwin. Name this French naturalist who thought that any characteristics acquired during an organism's lifetime would be passed on to its offspring.

ANSWER: Jean Chevalier de Lamarck

TOSS-UP

17. EARTH SCIENCE: Short Answer: What word, directly translated from the Greek, describes a mineral deposit that precipitates from a fluid whose main ingredient is hot water?

ANSWER: hydrothermal

BONUS

17. EARTH SCIENCE: Multiple Choice: In the United States, a red one is called a "ruby", but the term applies to all other colors of corundum or aluminum oxide. What gem's most expensive varieties are bright blue and come from India?

- W) amethyst
- X) garnet
- Y) sapphire
- Z) emerald

ANSWER: Y) sapphire

TOSS-UP

18. GENERAL SCIENCE: Multiple Choice: In engineering, which of these terms describes a working model that is built to evaluate an idea before a final product is officially manufactured?

- W) unofficial
- X) iteration
- Y) peripheral
- Z) prototype

ANSWER: Z) prototype

BONUS

18. GENERAL SCIENCE: Short Answer: In astronomy, it describes anything that is a gas at room temperature. What adjective that can also mean "highly explosive" can describe someone's highly-strung temperament where they may explode at any moment?

ANSWER: volatile

TOSS-UP

19. CHEMISTRY: Short Answer: Cooling it to 300 degrees below zero and putting 25 million pounds of pressure on it per square inch changes it from a diatomic gas into a solid. Name this chemical element that makes up nearly 80% of the earth's atmosphere.

ANSWER: nitrogen

BONUS

19. CHEMISTRY: Short Answer: Found naturally in compounds like ilmenite [ILL-ma-night] and rutile [ROO-tile], its dioxide form is the world's most popular chemical for making things white. Name this strong and lightweight metallic element also used in aircraft parts and space capsules.

ANSWER: titanium

TOSS-UP

20. MATH: Multiple Choice: The well-known numbers e and π fit into what category of numbers that cannot be expressed as a fraction with any two integers?

- W) irrational numbers
- X) real numbers
- Y) complex numbers
- Z) counting numbers

ANSWER: W) irrational numbers

BONUS

20. MATH: Multiple Choice: The numbers e and π also fit into what category of numbers that are not roots of any polynomial equation with integer coefficients?

- W) imaginary numbers
- X) whole numbers
- Y) transcendental numbers
- Z) infinitesimal numbers

ANSWER: Y) transcendental numbers

TOSS-UP

21. CURRENT EVENTS: Multiple Choice: In the summer of 2003, what planet got within 35 million miles of the earth?

- W) Mars
- X) Venus
- Y) Jupiter
- Z) Mercury

ANSWER: W) Mars

BONUS

21. CURRENT EVENTS: Short Answer: In 2004, the World Health Organization stated that more than 300,000 people every year catch a strain of it that is resistant to more than one drug. Identify this disease whose sufferers were once sent to a sanatorium.

ANSWER: tuberculosis or TB

TOSS-UP

22. BIOLOGY: Short Answer: Its Group B is now the main cause of life-threatening infections in newborn babies. Group A can cause rheumatic fever and also contains the so-called "flesh-eating bacteria". Identify this genus of bacteria that most commonly causes a very sore throat.

ANSWER: streptococcus

BONUS

22. BIOLOGY: Short Answer: It is used by nurses to check the breathing, pulse, muscle tone, skin color and reflexes of newborn babies. Identify this 10-point scale named for its founder.

ANSWER: (Virginia) Apgar scale

TOSS-UP

23. MATH: Multiple Choice: A village of 50,000 people is attacked by bubonic plague that kills 10% of the village every day. How many people will be left in the village after 3 days, when medication finally arrives?

- W) 45,000
- X) 40,500
- Y) 36,450
- Z) 35,000

ANSWER: Y) 36,450 (45,000, then 40,500, then 36,450)

BONUS

23. MATH: Multiple Choice: Calculate the determinant of the two-by-two matrix with a top row of 7 and 5 and a bottom row of 8 and 6.

- W) 26
- X) 15
- Y) 2
- Z) -7

ANSWER: Y) 2 ($42 - 40$)

TOSS-UP

24. CHEMISTRY: Short Answer: What term describes a substance that speeds up a chemical reaction without being changed itself?

ANSWER: catalyst

BONUS

24. CHEMISTRY: Short Answer: An aerosol is one type of it that involve gases, while a gel is another type that involves liquid. What is this substance made up of small particles evenly dispersed within another material that is in the intermediate state between a suspension and a solution?

ANSWER: colloid

TOSS-UP

25. PHYSICS: Short Answer: For the first time in 60 years, the University of California may not be managing it when its current contract runs out. What New Mexico laboratory was built during World War II to develop the atomic bomb?

ANSWER: Los Alamos National Laboratory

BONUS

25. PHYSICS: Multiple Choice: It is the average of an object's elements of mass, factored by their distances from a reference. Name this quantity, often found using a plumb bob, that describes an object's response to external forces and torques.

- W) center of gravity
- X) specific density
- Y) moment of inertia
- Z) potential energy

ANSWER: W) center of gravity

END OF ROUND 4